

百合科细胞分类学研究*

——(2)浙江产 8 属 8 种的染色体数目和核型报道

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CYTOTAXONOMICAL STUDIES ON LILIACEAE (S.1.); (2) REPORT ON CHROMOSOME NUMBERS AND KARYOTYPES OF 8 SPECIES OF 8 GENERA FROM ZHEJIANG, CHINA

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Abstract Eight species in eight genera of Liliaceae from Zhejiang were cytotaxonomically studied in this work. The karyotypes of Chinese materials of these species are mostly reported for the first time. The results are shown as follows (see Table 2—4 for chromosome parameters of them):

1. **Disporum sessile** D. Don Sixteen chromosomes are counted at metaphase of root-tip cells. The Karyotype formula is $2n=16=2m+2sm+4st+2m+3sm+1sm(SAT)+2st$ (Plate 1: 2—3; see Fig. 1:1 for its idiogram). The Karyotype belongs to 3B in Stebbins' (1971) karyotype classification, and consists of four pairs of larger chromosomes (1—4) and four pairs of smaller chromosomes (5—8). One SAT-chromosome is situated at the sixth pair. The chromosomes range between 4.85—16.63 μm . The karyotypic constitution is similar to that of Japanese material reported by Noguchi (1974). Chang and Hsu (1974) reported $2n=14=13st+1sm$ and $2n=16=2m+13st+1sm$ for the material from Taiwan under the name of *D. shimadai* Hay. (= *D. sessile* D. Don). Compared with our result of *D. sessile*, the differences are obvious.

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2. **Polygonatum odoratum** (Mill.) Druce PMC's diakinesis shows eleven bivalents, $n = 11$, 5 large and 6 small (Plate 2:5). The meiosis is normal. The majority of reports of this species are $2n = 20$, with a few $2n = 22$ and 30 (see Table 1). The materials from southern Siberia and the Far East in USSR are all of $2n = 20$. Our result is the same as recorded by Jinno (1966) in the Japanese material and by Li (1980) from Beijing. Ge (1987) reported $2n = 20$ in the cultivated individuals of Shandong, China, showing that both $2n = 20$ and 22 exist in China.

3. **Scilla scilloides** (Lindl.) Druce This species has the somatic chromosome number $2n = 18$ (Plate 1: 4—6, see Fig. 1:2 for its idiogram), of which two groups of chromosomes can be recognized, i.e. the 1st—5th pairs of large and the 6th—9th pairs of small chromosomes. A distinct character of the karyotype is that two satellites are attached to the short arms of the 1st pair of chromosomes. The degree of asymmetry is of 3C. The karyotype formula is $2n = 18 = \overbrace{2sm(SAT)}^L + 6st + 2t + \overbrace{6m}^S + 2sm$. The chromosomes range from 2.02 to 11.93 μm . The Previous counts on the species are $2n = 16, 18, 26, 34, 35, 36$ and 43 (see Table 1). The present investigation confirms Noda's and Haga's results. The species is considered to be of two genomes, namely A($x = 8$) and B($x = 9$). Our result shows a genome composition of BB, having a pair of large SAT-chromosomes. Chang and Hsu (1974) reported $2n = 34$ from a population of Taiwan, an amphidiploid (AABB). Karyotypes of other Chinese populations are worth further researches.

4. **Tricyrtis macropoda** Miq. The chromosome number of somatic cells is $2n = 26$, and PMC's MII shows 13 bivalents ($n = 13$) (Plate 3:1—3, see Fig. 1:3 for its idiogram). The karyotype formula is $2n = 26 = 6m + 10sm + 6st + 4st$ (or t), which is composed of chromosomes: 4L + 22S in size. The degree of asymmetry is of 3B. No centromeres of the 12th and 13th pairs of chromosomes were observed at metaphase, and the chromosomes may be of st or t . Nakamura (1968) reported $2n = 26(4L + 22S) = 2sm + 2sm - st + 14st - sm + 8st$ for *T. macropoda* Miq. and $2n = 26(4L + 22S) = 8m + 2sm + 2sm - st + 2st - sm + 12st$ for its ssp. *affinis*, both from Japan. It is clear that the major character of their karyotypes, i. e. 4L + 22S, is consistent with that reported here. Based on the previous and present reports, all *Tricyrtis* species studied are remarkably uniform in the basic karyotype, i. e. 4L + 22S.

5. **Allium macrostemon** Bunge. The present observation on the root-tip cells of the species shows $2n = 32$ (Plate 3: 4—5, see Fig. 1: 4 for its idiogram). The karyotype formula is $2n (4x) = 32 = 26m + 6sm$, which belongs to 2B, being of high symmetry. Except the 6th, 10th and 13th pairs of chromosomes all the are metacentric. Chromosomes of this species are large, ranging from 5.94 to 18.06 μm . Our result agrees with Kawano's (1975) report under the name of *A. grayi* Regel (= *A. macrostemon*, Wang and Tang 1980).

6. **Asparagus cochinchinensis** (Lour.) Merr. Ten bivalents were observed in PMC's MI, $n = 10$ (Plate 1: 1). The present result confirms the number of a population of Taiwan recorded by Hsu (1971).

7. *Ophiopogon japonicus* (L. f.) Ker-Gawl. The species from Mt. Taogui, Hangzhou, is found to have $2n(2x) = 36 = 22m + 14sm$ (Plate 2: 1, 5; see Fig. 1: 5 for its idiogram) which belongs to 2B. The karyotype is composed of 2 medium-sized chromosomes with metacentric centromeres and 34 small chromosomes, ranging from 1.34 to 4.92 μm . The populations from Mt. Tianzhu and Mt. Yuling, Zhejiang, are found to be aneuploids at tetraploid level ($2n=64-70$). It is interesting that Nagamatsu (1971) found the karyotypes of Japanese materials to be $2n=67$ and 68, also showing unsteady $4x$ karyotypes of this species. In the previous reports (see Table 1), the chromosome numbers of this species are mainly $2n=72$, besides $2n=36$ recorded by Sato (1942) from Japan.

8. *Liriope platyphylla* Wang et Tang The somatic complement of the species collected from Mt. Tianzhu, Hangzhou, is $2n=36$ (Plate 2: 3-4, see Fig. 1: 6 for its idiogram). The karyotype is $2n(2x) = 36 = 16m + 20sm$, belonging to 2B type. The chromosomes are small except the medium-sized, 1st pair and the range is from 1.27 to 5.19 μm . The material from Mt. Yuling, Zhejiang, is found to have a variety of chromosome numbers ($2n=60-71$), as observed in *Ophiopogon japonicus*. Hasegawa (1968) reported the karyotype of $2n=72(4x)$ from Japan. The $2x$ karyotype is first recorded.

This genus is closely related to *Ophiopogon*. Based on the Hasegawa's and present studies, all the species in these two genera are remarkably uniform in karyotype. Therefore, the taxonomy of the two genera is worth further researches.

Key words Karyotype; Cytotaxonomy; Liliaceae; Zhejiang, China

摘要 本文对浙江产的 *Disporum sessile*, *Tricyrtis macropoda*, *Scilla scilloides*, *Ophiopogon japonicus*, *Liriope platyphylla* 和 *Allium macrostemon* 的核型作了分析, 并报道了 *Polygonatum odoratum* 和 *Asparagus cochinchinensis* 的单倍体染色体数目。其中绝大多数为国产材料的首次记载。

关键词 核型; 细胞分类; 百合科; 中国浙江

中国百合科 Liliaceae 的细胞分类学研究前已作过若干报道(洪德元等, 1987), 本文系该研究工作的一部分, 着重分析了产于中国浙江的 8 种植物的染色体数目和核型。

材 料 和 方 法

所有种类的材料均取自野外自然生长的植株, 取生长旺盛的根尖和幼小的花药。根尖用 0.05% 的秋水仙碱溶液处理 2-4 小时, 用卡诺固定液固定过夜, 在 0.1 mol/LHCl 中于 60℃ 下水解 8-10 分钟, 用石碳酸品红滴染压片。花药材料直接用卡诺液固定, 其余略同根尖材料。核型分析采用李懋学等(1985)的标准。

材料来源见附录, 凭证标本存放浙江农业大学植物标本室。

观察结果与讨论

1. 宝铎草 *Disporum sessile* D. Don

根尖细胞染色体 $2n=16$ (图版 1: 2, 3), 核型模式图见图 1: 1, 染色体参数见表

表1 百合科8种的染色体数目

Table 1 The chromosome numbers of 8 spp. of Liliaceae

Present results				Previous reports		
Species	n	2n	Localities	n	2n	Authors (Localities)
<i>Disporum sessile</i>		16	Mt. Nangao, Hangzhou	8	16 16, 24 16	Washiashi 1936 (Jap.). Hasegawa 1932a, b (Jap.). Therman 1956 (cul.). Fujishima 1973, Noguchi 1974 (Jap.), Lee 1967 (Korea).
<i>Polygonatum odoratum</i>	11		Mt. Siming, Zhejiang	11	22 20 22 20 20 26-30 29 30	李懋学 1980 (China). 葛传吉 1987 (cult.). Jinno 1966 (Jap.). Krasnikova et al. 1983, Krasnoborov et al. 1980, Probatova 1983 (USSR) Inoue 1965 (cf. Ornduff 1965), Skalinska 1971 (cf. Moore 1973), Maude 1939 (cf. Darlington 1955), Abramov 1970 (cf. Moore 1973), Krogulevich 1978 (cf. Goldblatt 1982).
<i>Scilla scilloides</i>		18	Mt. Nangao, Hangzhou		18, 26, 27, 34, 35, 43. 18, 26, 27, 34, 35+1-3f 18, 26, 27, 34, 35, 36, 43. 16 34	Haga 1961 (Jap.) Noda 1967, 1974a, b. (Jap.). Haga & Noda 1976 (Jap.). Haga & Noda 1976 (Korea). Chang & Hsu 1974 (Taiwan, China).
<i>Tricyrtis macropoda</i>	13	26	Mt. Tianzhu and Mt. Siming, Zhejiang	13	26 26	Sinoto & K 1932 (Jap.). Nakamura 1968 (Jap.).
<i>Allium macrostemon</i>		32	Mt. Yuling, Zhejiang			
<i>Asparagus cochinchinensis</i>	10		Mt. Nangao, Hangzhou	10		Hsu 1971 (Taiwan, China)
<i>Ophiopogon japonicus</i>		36	Mt. Taogui, Hangzhou		36, 72. 72 67, 68.	Sato 1942 (Jap.). Sharma et al. 1964 (India), Hasegawa 1968 (Jap.), Hsu 1971 (Taiwan, China). Nagamatsu & Noda 1971 (Jap.).
<i>Liriope platyphylla</i>		36	Mt. Tianzhu, Hangzhou		36 72	葛传吉 1987, (cult.). Hasegawa 1968 (Jap.).

2。核型公式为 $2n(2x) = 16 = 2m + 2sm + 4st + 2m + 3sm + 1sm(SAT) + 2st$ 。基本可分为 4 对较大的 L 和 4 对较小的 S 二组。除第 2 对和第 8 对外，其余均为 sm 和 st 着

表 2 宝铎草和绵枣儿的染色体参数

Table 2 The parameters of chromosomes in *Disporum sessile* and *Scilla scilloides*

分类单位 Taxon	编 号 No.		相对长度 Relative length	臂 比 Arm ratio	染色体类型 Types	置信区间(95%) 95% confidence limits
<i>Disporum sessile</i>	L	1	$7.41+2.92=10.33$	2.54	sm	2.26—2.82
		2	$5.29+4.07=9.36$	1.30	m	1.20—1.40
		3	$5.71+1.89=7.60$	3.02	st	2.64—3.40
		4	$5.12+1.70=6.83$	3.01	st	2.73—3.29
	S	5	$3.91+1.18=5.09$	3.31	st	2.61—4.01
		6	$3.01+1.03=4.04$	2.92	sm* (1SAT)	2.62—3.22
		7	$2.66+1.10=3.76$	2.42	sm	1.89—2.95
		8	$1.92+1.25=3.17$	1.54	m	1.41—1.67
<i>Scilla scilloides</i>	L	1	$7.32+2.57=9.89$	2.86	sm** (SAT)	2.51—3.21
		2	$6.78+1.61=8.39$	4.22	st	3.43—5.01
		3	$6.57+0.97=7.54$	6.77	st	6.11—7.42
		4	$5.92+0.81=6.73$	7.27	t	5.47—9.09
		5	$5.41+0.88=6.29$	6.15	st	5.19—7.11
	S	6	$1.92+1.74=3.66$	1.10	m	1.03—1.17
		7	$1.69+1.32=3.01$	1.28	m	1.12—1.44
		8	$1.45+1.21=2.56$	1.20	m	1.08—1.32
		9	$1.53+0.74=2.27$	2.07	sm	1.63—2.51

* 随体长度未计内; ** 随体长度计在内。

* The length of SAT is not calculated in the short arm.

** The length of SAT is included in the short arms.

丝粒的。最长与最短染色体比值为 3.26, 核型类型属 3B 型 (Stebbins 1971)。染色体大型, 绝对长度变化幅度平均值为 $4.85-16.63 \mu\text{m}$ 。第 6 对染色体的一条短臂上常具随体。该种的国产居群为首次报道。

对本种染色体的研究在国外的报道较多 (见表 1), 数目主要为 $2n=16$, 仅 Hasegawa (1932b) 发现过 $2n=24$ 的细胞型。国产居群的数目与前人的报道是一致的。在核型结构上与日本产植株基本相似, 但与 Hasegawa (1932a) 报道的相比, 第 1 对与第 2 对的位置有所颠倒, 并且每对染色体的臂比值除第 1、3、4 对外, 均超出国产材料的 95% 置信区间。然而与 Noguchi 等 (1974) 报道的模式图相比, 顺序是一致的, 但他们未报道参数, 难作比较。对该种染色体随体的变异规律, Fujishima 等 (1973) 作了研究, 发现有 8 种类型, 数目从 1—6 变化不定; 最稳定的是第 3 对有 1 个 SAT, 第 6 对 2 个 SAT。国产材料仅出现 1 个 SAT (第 6 对)。Fujishima 报道的核型参数, 在臂比值与染色体类型的划分上与 Levan (1964) 的方法不同, 难于与本材料作比较。

2. 玉竹 *Polygonatum odoratum* (Mill.) Druce.

花粉母细胞减数分裂终变期 (diakinesis) 观察到 11 个双价体 (图版 2:2), $n=11$ 。染色体构形表现为 5 大, 6 小。

本种系欧亚大陆温带的广布种, 形态变异较大。对其染色体的研究工作报道较多 (见表 1)。多数报道 $2n=20$, 少数为 22 和 30。苏联的材料均为 20 和 30, 未见有 22 的报

道。 $2n = 22$ 仅见中国和日本的材料。我们的结果与 Jinno (1966) 报道日本的材料相同 ($n = 11$, $2n = 22$), 与李懋学等(1980)所做北京金山的材料一致 ($2n = 22$), 但与葛传吉(1987)报道山东栽培植株 ($2n = 20$) 不同。表明我国存在 $2n = 22$ 和 $2n = 20$ 的自然居群。四明山居群与北京金山居群核型结构是否相同待分析。该种形态变异与染色体数目、核型及地理分布的关系值得探讨。

3. 绵枣儿 *Scilla scilloides* (Lindl.) Druce.

根尖细胞观察到 $2n = 18$ (图版 1:4, 6), 核型模式图见图 1:2, 各对染色体参数见表 2。核型公式为 $2n = 18 = 6m + 2sm + 2sm(SAT) + 6st + 2t$ 或 $\overbrace{2sm(SAT)}^L + \overbrace{6st + 2t}^L + \overbrace{6m + 2sm}^S$ 。最长与最短染色体的比值为 4.36, 核型类型属 3C, 高度不对称。染色体形态明显分为两组: 5 对大型 (L), 均为 *st* 着丝粒的, 在第 1 对的短臂上具一个大随体; 4 对小型 (S) 的, 除第 9 对为 *sm* 外, 其余均为 *m*。绝对长度变异幅度为 2.02—11.93 μm 。国产 $2n = 18$ 的材料为第一次记载。在观察中还发现具 19 条染色体的核型, 占观察细胞的 16.7%, 多余的一条长度最短, 不能见到着丝粒(图版 1:6)。

对该种染色体的研究已有多次记载(见表 1), 数目变化相当惊人, 并且有数目不定的 *f* 或 *B* 染色体。染色体数目变化在 16—43 条。从表中可见, 大多数日本学者都报道过 $2n = 18$ 的核型, Noda (1974a, b) 以及 Haga & Noda (1976) 报道了日本材料 $2n = 18$ 的核型模式, 与我们的结果是一致的, 也存在一对核仁染色体, 短臂上具大随体。一般认为该种有两种不同的染色体组 $A(x = 8)$ 和 $B(x = 9)$ [cf. Noda (1974a, b); Haga & Noda (1976)]。A 染色体组的显著特点是第一对为 *m* 染色体, B 染色体组的特点是第一对染色体的短臂上有一个大随体。我们的结果表明, 我国大陆的组型为 BB。Chang & Hsu (1974) 报道了我国台湾产植株为 $2n = 34$ (AABB), 系双二倍体, 但未见有大随体染色体。Haga & Noda (1976) 指出日本除 AA($2n = 16$) 外, 其它组型都存在, 而 AA 仅局限于朝鲜; 相反 BB($2n = 18$) 在朝鲜未发现。我国大陆其它居群情况如何, 值得研究。

Sato (1935, 1942) 和 Ginenez (1959) 对当时作为 *S. chinensis* Benth. 的植株作过报道: $2n = 18, 26, 34, 35$ 和 36 ; Morinaga (1932) 和 Sato (1935, 1940) 对当时作为 *S. japonica* Baker 的植株作过研究, 记载为 $2n = 16, 18, 26, 34, 35$ 和 43 。目前认为均系同一种, 为 *S. scilloides* 的异名(汪发绩、唐进 1980)。从染色体资料看也是一致的。

4. 油点草 *Tricyrtis macropoda* Miq.

根尖材料取自杭州天竺山, 花药材料取自浙东四明山(溪口千丈岩)。观察结果: 体细胞 $2n = 26$ (图版 3:1, 2), 核型模式图见图 1:3, 染色体参数见表 3, 核型公式为 $2n(2x) = 26 = 6m + 10sm + 6st + 4t$ (或 *st*)。最长与最短染色体比值为 3.56, 属 3B 核型, 高度不对称。第 1, 2 对染色体较大, 长可达 $9\mu m$, 均具 *st* 着丝粒; 其余各对大小呈梯度变化。绝对长度变化幅度为 2.14— $8.28\mu m$ 。第 12、13 对(最小二对)在分裂相中均不易见到着丝点位置, 推测它们的染色体具有 *t* 或 *st* 着丝粒。花粉母细胞减数分裂 MII 见到 13 条染色体, $n = 13$ (图版 3:3)。从数目上与天竺山居群是一致的。国产该

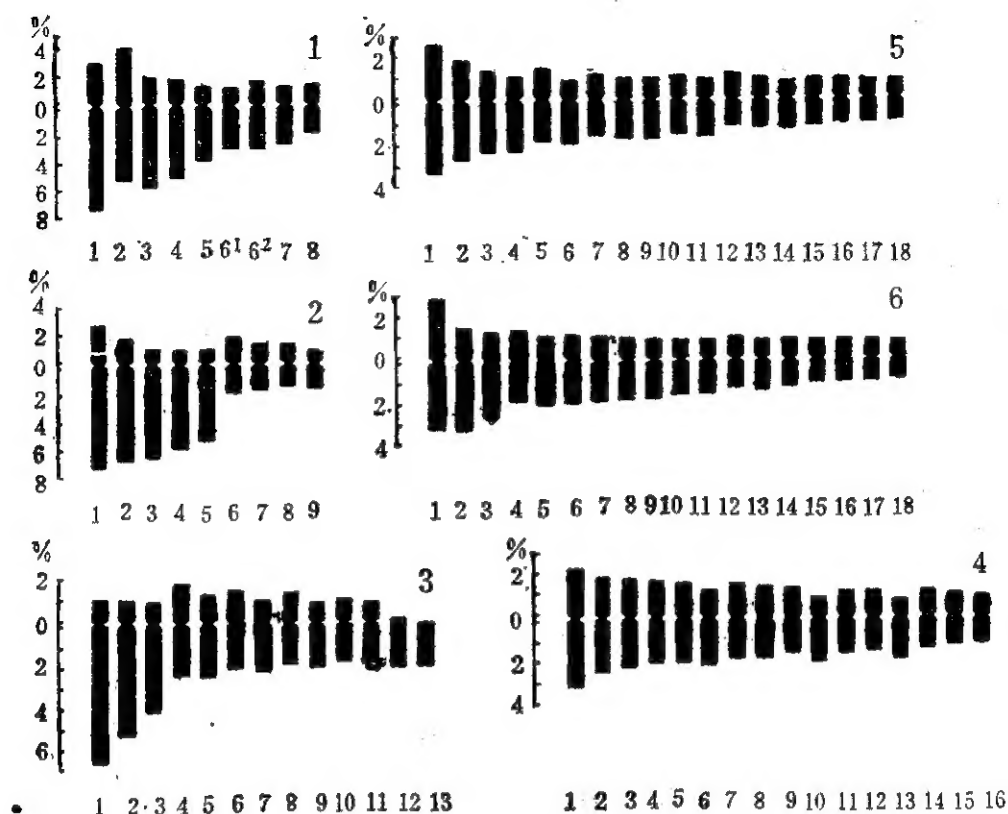


图1 百合科 6 个种的核型模式图 1. 宝铎草; 2. 绵枣儿; 3. 油点草;
4. 薤白; 5. 麦冬; 6. 阔叶山麦冬。

Fig. 1 Idiograms 1. *Disporum sessile*; 2. *Scilla scilloides*;
3. *Tricyrtis macropoda*; 4. *Allium macrostemon* 5. *Ophiopogon japonicus*; 6. *Liriope platyphylla*.

种材料的核型为首次报道。

该属仅局限分布亚洲东部, 本种则局限分布我国南部和日本。由于分布的局限性, 所以对本种细胞学研究的报道仅出自日本学者。Sinoto & Kikkawa (1932) 观察过日本和我国的材料, $2n = 26$, 与本文结果一致。Nakamura (1968) 报道了日本产该种及 subsp. *affinis* 的核型: 前者为 $2n = 26 = 2sm + 2sm - st + 14st - sm + 8st$, 表现为 $4L + 22S$, 绝对长度为 $2.5-5.7\mu m$; 后者 $2n = 26 = 8m + 2sm + 2sm - st + 2st - sm + 12st$, 表现为 $4L + 22S$, 绝对长度为 $2.9-7.3\mu m$ 。可见核型主要特征, 即 4 条较大 (L) 和 22 条较小 (S) 的染色体, 与国产居群是一致的。在核型结构上, 国产居群与前者 (日本产 *T. macropoda*) 差异较大, 而与后者 (日本产 *T. macropoda* ssp. *affinis*) 接近; 国产居群的绝对长度为 $2.14-8.28\mu m$ 也表明这一点。因 Nakamura 未报道参数, 所以尚不能推测引起核型差异的主要因素。Nakamura (1968) 曾报道了它们的分布: *T. macropoda* ssp. *affinis* 分布日本全岛, 而 *T. macropoda* 仅分布日本南部。因此浙江的材料是否属于 ssp. *affinis* 值得探讨。

表3 油点草和薤白的染色体参数

Table 3 The parameters of chromosomes in *Tricyrtis macropoda* and *Allium macrostemon*

分类单位 Taxon	编号 No.	相对长度(%) Relative length	臂比 Arm ratio	染色体类型 Types	置信区间(95%) 95% confidence limits
<i>Tricyrtis macropoda</i>	1	6.62±1.08=7.70	6.12	st	5.58—6.76
	2	5.32±1.02=6.34	5.22	st	4.23—6.21
	3	4.17±0.89=5.06	4.69	st	3.51—5.87
	4	2.39±1.79=4.18	1.34	m	1.18—1.50
	5	2.44±1.26=3.70	1.94	sm	1.78—2.10
	6	2.09±1.46=3.55	1.43	m	1.34—1.52
	7	2.19±1.00=3.19	2.19	sm	1.86—2.52
	8	1.79±1.37=3.16	1.31	m	1.18—1.44
	9	2.05±0.87=2.92	2.36	sm	2.01—2.71
	10	1.72±1.00=2.72	1.72	sm	1.52—1.92
	11	1.74±0.84=2.58	2.07	sm	1.61—2.53
	12	2.36		st or t*	
	13	2.16		st or t*	
<i>Allium macrostemon</i>	1	3.17±2.28=5.45	1.39	m	1.20—1.58
	2	2.44±1.81=4.25	1.35	m	1.22—1.48
	3	2.20±1.74=3.94	1.26	m	1.16—1.42
	4	2.06±1.66=3.72	1.24	m	1.08—1.40
	5	2.00±1.52=3.52	1.32	m	1.10—1.54
	6	2.17±1.14=3.31	1.91	sm	1.28—2.54
	7	1.81±1.45=3.26	1.25	m	1.08—1.42
	8	1.81±1.38=3.19	1.31	m	1.12—1.50
	9	1.59±1.31=2.90	1.21	m	1.01—1.41
	10	2.05±0.77=2.82	2.67	sm	2.24—3.10
	11	1.61±1.13=2.74	1.43	m	1.29—1.57
	12	1.45±1.11=2.56	1.30	m	1.03—1.57
	13	1.81±0.66=2.47	2.74	sm	2.22—3.26
	14	1.35±1.09=2.44	1.24	m	1.09—1.39
	15	1.14±0.97=2.11	1.18	m	1.05—1.31
	16	1.11±0.80=1.91	1.39	m	1.23—1.55

* 未观察到着丝粒位置,估计为 st 或 t。

* the position of centromeres was not observed.

该属染色体数目初步统计约有 9 种已作过记录,数目比较稳定,以 $2n = 26$ 为主,仅 *T. formosana* 有 $2n = 52 (4x)$ 的记载。看来 13 是该属的基数。

5. 薤白 *Allium macrostemon* Bunge.

材料取自浙江安徽交界的昱岭(顺溪)。根尖细胞观察到 32 条染色体(图版 3:4, 5),核型模式见图 1:4, 各对染色体参数列于表 3。核型公式为 $2n(4x) = 32 = 26m + 6sm$ 。最长与最短染色体比值为 2.85, 属 2B 核型, 对称性较高。染色体较大, 各对大小呈梯度变化, 除第 6、10、13 对外均为 m 染色体。绝对长度变化幅度为 5.94—18.06 μm 。国产材料为首次报道。

本种分布较广, 异名甚多。染色体方面的报道以学名 *A. macrostemon* 记载的, 我们

尚未见到。Kawano 等 (1975) 报道过 *A. grayi* Regel [现作为 *A. macrostemon* 的异名, 汪发绩和唐进 (1980)] 的数目 $2n = 32$, 与我们的结果是一致的。与邻近种 *A. chinensis* G. Don 的数目 $2n = 32$ 也相同 (Brat, 1965)。

6. 天门冬 *Asparagus cochinchinensis* (Lour.) Merr.

本种广布于东亚至东南亚。在杭州南高峰的材料中, 花粉母细胞减数分裂双线期可见 10 个双价体 (图版 1:1), $n = 10$, 与 Hsu (1971) 报道我国台湾产植株 $n = 10$ 一致。

7. 麦冬 *Ophiopogon japonicus* (L. f.) Ker-Gawl.

从根尖细胞观察到 $2n = 36$ (图版 2:1, 5), 核型模式图见图 1:5, 各对染色体参数见表 4。核型公式为 $2n = 36 = 22m + 14sm$ 。最长与最短染色体比值为 3.37, 属 2B 核型, 对称性较高。染色体中小型, 各对大小除第一对外呈梯度变化。绝对大小变化幅度为 $1.34-4.92\mu m$ 。如按目前的认识: 18 是该属的基数, 则本居群材料为 $2x$ 。我们还观察了取自杭州天竺山和顺溪的材料, 发现数目变化在 64—70, 观察数十个细胞未见有整 $4x$ ($2n = 72$) 的核型。该材料核型待分析。国产 $2x$ 核型为首次分析。

自 Sato (1942) 报道日本产植株 $2n = 36, 72$ 以来, 又有多人对该种作过研究 (见表 1)。除 Sato (1942) 记载过 $2n = 36$ 的植株外, 其余报道多为 $2n = 72$ 。我们的结果与 Sato (1942) 报道的 $2n = 36$ 一致, 他的材料的核型也存在二条较大的染色体, 其余

表 4 麦冬和阔叶山麦冬的染色体参数

Table 4 The parameters of chromosomes in *Ophiopogon japonicus* and *Liriope platyphylla*

<i>Ophiopogon japonicus</i>					<i>Liriope platyphylla</i>				
编号 No.	相对长度 Relative length	臂比 Arm ratio	染色体 类型 Types	置信区间(95%) 95% Confidence limits	编号 No.	相对长度 Relative length	臂比 Arm ratio	染色体 类型 Types	置信区间(95%) 95% confidence limits
1	$3.36 \pm 2.60 = 5.96$	1.29	m	1.19—1.39	1	$3.12 \pm 2.83 = 5.95$	1.10	m	1.04—1.16
2	$2.69 \pm 1.89 = 4.58$	1.42	m	1.31—1.53	2	$3.26 \pm 1.40 = 4.66$	2.33	sm	2.02—2.64
3	$2.36 \pm 1.30 = 3.66$	1.82	sm	1.65—1.99	3	$2.67 \pm 1.25 = 3.92$	2.14	sm	1.75—2.53
4	$2.35 \pm 1.03 = 3.38$	2.28	sm	1.86—2.70	4	$1.81 \pm 1.32 = 3.13$	1.37	m	1.20—1.54
5	$1.87 \pm 1.38 = 3.25$	1.36	m	1.22—1.50	5	$2.06 \pm 1.00 = 3.06$	2.06	sm	1.67—2.45
6	$1.96 \pm 0.76 = 2.72$	2.58	sm	2.01—3.15	6	$1.96 \pm 1.08 = 3.04$	1.81	sm	1.31—2.31
7	$1.55 \pm 1.09 = 2.64$	1.42	m	1.09—1.75	7	$1.82 \pm 0.93 = 2.75$	1.95	sm	1.42—2.48
8	$1.70 \pm 0.87 = 2.57$	1.95	sm	1.84—2.06	8	$1.77 \pm 0.85 = 2.62$	2.08	sm	1.74—2.42
9	$1.71 \pm 0.82 = 2.53$	2.09	sm	1.85—2.33	9	$1.70 \pm 0.78 = 2.48$	2.19	sm	1.94—2.44
10	$1.50 \pm 0.98 = 2.48$	1.53	m	1.38—1.68	10	$1.57 \pm 0.75 = 2.32$	2.10	sm	1.81—2.39
11	$1.66 \pm 0.73 = 2.39$	2.27	sm	2.11—2.42	11	$1.52 \pm 0.76 = 2.28$	2.10	sm	1.72—2.48
12	$1.18 \pm 1.04 = 2.22$	1.13	m	1.07—1.19	12	$1.26 \pm 0.95 = 2.21$	1.32	m	1.13—1.51
13	$1.24 \pm 0.84 = 2.08$	1.48	m	1.15—1.79	13	$1.37 \pm 0.74 = 2.11$	1.85	sm	1.43—2.27
14	$1.31 \pm 0.66 = 1.97$	1.98	sm	1.79—2.17	14	$1.24 \pm 0.82 = 2.06$	1.52	m	1.20—1.84
15	$1.12 \pm 0.80 = 1.92$	1.40	m	1.19—1.61	15	$1.08 \pm 0.80 = 1.88$	1.35	m	1.22—1.48
16	$1.05 \pm 0.80 = 1.85$	1.31	m	1.08—1.54	16	$1.01 \pm 0.81 = 1.82$	1.24	m	1.11—1.37
17	$1.02 \pm 0.79 = 1.81$	1.29	m	1.18—1.40	17	$1.00 \pm 0.75 = 1.75$	1.34	m	1.14—1.54
18	$0.99 \pm 0.78 = 1.77$	1.27	m	1.09—1.45	18	$0.83 \pm 0.74 = 1.57$	1.12	m	1.06—1.18

的呈梯度变化;但他未报道参数,尚不能全面比较。

Nagamatsu (1971) 对日本的材料记录到体细胞 $2n = 67, 68$ 。我们观察的天竺山和顺溪的材料也发现有这类非整倍体的核型。由此可见本种具有 $2x$ 和 $4x$ 二种核型,而 $4x$ 核型在染色体数目上不稳定,这可能与本种部分行根状茎繁殖有关。Hsu (1971) 报道本种台湾材料 $2n = 72$, 表明我国这两种倍性的居群都存在。

8. 阔叶山麦冬 *Liriope platyphylla* Wang et Tang

材料取自杭州天竺山和浙江顺溪昱岭。前者的根尖体细胞观察到 $2n = 36$ (图版 2: 3, 4), 核型模式图见图 1: 6, 各对染色体参数见表 4。核型公式为 $2n = 36 = 16m + 20sm$ 。最长与最短染色体比值为 3.79, 属 2B 核型。染色体中小型, 各对大小除第一对外, 呈梯度变化。绝对长度变化幅度为 $1.27-5.19\mu m$ 。如以 18 为该属的基数, 则本居群为 $2x$ 。后者(顺溪)体细胞观察到的现象与麦冬 *Ophiopogon japonicus* 有类似, 数目也变化在 60—71 之间。国产材料的 $2x$ 核型为首次分析。

该属系东亚分布的小属, 主产我国; 本种则是一个分布较广、分类上异名较多的种。在核型研究方面, Hasegawa (1968) 报道了日本的材料 $2n = 72$ 。葛传吉(1987)记录了山东栽培植株 $2n = 36$, 与我们观察的天竺山植株相同。Westfall (1950) 和 Oinuma (1946) 曾分别报道 *L. muscari* Bailey (= *L. platyphylla*, 汪发绩和唐进, 1951) $2n = 72$ 和 $2n = 72$ 及 108。

本属与麦冬属很接近, 形态上区别仅在于子房位置(上位或半下位)和花药形状。 $2x$ 麦冬和 $2x$ 阔叶山麦冬的核型也很相似, 如染色体形态、大小和核型类型; 区别仅表现在后者对称性稍低, 即臂比大于 2:1 的染色体的百分比和最长最短染色体比值较大(见表 4)。这二个属核型和属间关系值得深入研究。

Appendix: The origin of the materials

- Disporum sessile* D. Don, Mt. Nangao, Hangzhou, May 14, 1987, 傳承新, 杭 87051.
Polygonatum odoratum (Mill.) Druce., Mt. Siming, Zhejiang, April 24, 1987, 傳承新 871050.
Scilla scilloides (Lindl.) Druce., Mt. Tianzhu Hangzhou, Sep. 18, 1987, 傳承新, 杭 87083; Mt. Nangao, Hangzhou, Oct. 9, 1987, 傳承新, 杭 87190.
Tricyrtis macropoda Miq., Mt. Tianzhu, Hangzhou, Oct. 9, 1987, 傳承新, 杭 87179; Mt. Siming, Zhejiang, April 24, 1987, 傳承新 871054.
Allium macrostemon Bunge, Mt. Yuling, Zhejiang Nov. 26, 1987, 傳承新 87216.
Asparagus cochinchinensis (Lour.) Merr., Mt. Nangao, Hangzhou, April 30, 1987, 傳承新, 杭 87020.
Ophiopogon japonicus (L. f.) Ker-Gawl., Mt. Taogui, the suburbs of Hangzhou, Dec. 1, 1987, 傳承新 87223; Mt. Tianzhu, Hangzhou, Oct. 9, 1987, 傳承新, 杭 87180; Mt. Yuling, Zhejiang, Nov. 26, 1987, 傳承新 87215.
Liriope platyphylla Wang et Tang, Mt. Tianzhu, Hangzhou, Oct. 9, 1987, 傳承新, 杭 87181; Mt. Yuling, Zhejiang, Nov. 26, 1987, 傳承新 87214.

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图版说明 Explanation of plates

Plate 1 1. *Asparagus cochinchinensis*, at meiosis of PMCs, $n=10$ ($\times 1500$); 2—3. *Disporum sessile* $2n=16$ (2×1260); 4—6. *Scilla scilloides*, $2n=18$ (the arrows indicating the large SAT-chromosomes, one A Chromosome missing) ($4,5 \times 2180$).

Plate 2 1,5. *Ophiopogon japonicus* $2n=36$ (1×2250); 2. *Polygonatum odoratum*, at diakinesis of PMCs, $n=11$ ($\times 1370$); 3—4. *Liriope platyphylla* $2n=36$ (3×1720).

Plate 3 1—3. *Tricyrtis macropoda* 1—2. $2n=26$ (1×1700), 3. MII in PMCs, $n=13$ ($\times 1810$); 4—5. *Allium macrostemon* $2n=32$ (4×1880).



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Plate 2

